Using the 2020 Pharmaceutical Pricing Reform as a Natural Experiment

1 Objective

In this note, I guide you step by step on how to use the December 2020 pharmaceutical pricing reform as a quasi-natural experiment to estimate its impact on drug prices.

Your outcome of interest is:

$$Y_{it} = \text{price of drug } i \text{ at time } t. \tag{1}$$

Your goal is to identify the causal effect of the reform on Y_{it}.

The key challenge is that you never observe the counterfactual (what prices would have been without the reform). You therefore need to construct a credible control group.

2 Nature of the Reform

Before specifying any model, it is important that you understand how the reform works.

The regulation:

- introduces new pricing rules (international benchmarking, price ceilings, etc.),
- imposes a specific constraint on generics (at least 30% cheaper than reference products),
- and applies these rules when drugs are processed administratively (registration, renewal, or repricing).

Two implications follow.

First, not all drugs are equally exposed to the reform.

Second, treatment does not necessarily occur at the same time for all drugs.

Your empirical strategy should reflect both dimensions.

3 Baseline Framework: Difference-in-Differences

You should start with a standard difference-in-differences (DiD) model:

$$Y_{it} = \alpha_i + \gamma_t + \beta(D_i \times Post_t) + \varepsilon_{it}, \tag{2}$$

where:

- α_i are drug fixed effects,
- γ_t are time fixed effects,
- D_i defines the treatment group,
- $Post_t = 1$ after the reform,
- β measures the effect of the reform.

Your main task is therefore to define D_i in a way that reflects how the reform actually operates.

4 Step 1: Generics as the Treatment Group

I recommend that you start with the cleanest and most policy-relevant definition of treatment.

Define:

$$D_i^{Gen} = \begin{cases} 1 & \text{if drug } i \text{ is a generic or biosimilar,} \\ 0 & \text{if drug } i \text{ is an originator.} \end{cases} \tag{3}$$

The intuition is straightforward.

The reform explicitly imposes a binding pricing rule on generics: they must be at least 30% cheaper than the reference product. This creates a direct and measurable treatment channel.

In this specification, you are asking the following question:

> Did prices of generics adjust differently from those of originators after the reform?

This should be your baseline specification, as it is both simple and directly grounded in the regulation.

5 Step 2: Imported vs Locally Produced Drugs

As a complementary exercise, you can define treatment based on origin:

$$D_i^{Imp} = \begin{cases} 1 & \text{if drug } i \text{ is imported,} \\ 0 & \text{if drug } i \text{ is locally produced.} \end{cases} \tag{4}$$

The idea is that imported drugs are priced using international benchmarks, while locally produced drugs depend more on domestic criteria such as integration rates.

This may generate differential effects of the reform.

However, you should be cautious. Imported and local drugs may differ along many dimensions unrelated to the reform (market segment, competition, etc.). For this reason, I suggest using this specification as a robustness check rather than your main result.

6 Step 3: Where Does the Reform Actually Bind?

A more economically meaningful approach is to focus on where the regulation actually binds.

Let:

- P_i^{pre} denote the pre-reform price,
- B_i denote the price implied by the new rules.

Define:

$$D_i^{Bind} = 1\{P_i^{pre} > B_i\}. \tag{5}$$

In this case:

- treated drugs are those whose prices exceed the new constraint,
- control drugs are those already below it.

The intuition is central.

A regulation only matters if it is binding. If a drug is already priced below the benchmark, the reform does not affect it. If it is above, the reform forces an adjustment.

This specification therefore aligns treatment with the actual mechanism of the policy.

If you can construct B_i, this becomes your most convincing design.

7 Step 4: Moving Beyond a Common Treatment Date

So far, you have assumed that the reform affects all drugs at the same time:

$$Post_t = 1 \quad \text{for } t \geq 2021. \tag{6}$$

However, this is unlikely to be accurate.

In practice, the reform applies when a drug is processed (registration, renewal, repricing). As a result, different drugs may be exposed at different dates.

This motivates moving to a staggered treatment design.

8 Step 5: Staggered Difference-in-Differences

Let:

$$G_i = \text{first period in which drug } i \text{ is priced under the new rules.} \tag{7}$$

Define treatment as:

$$Treatment_{it} = 1\{t \geq G_i\}. \tag{8}$$

You then estimate:

$$Y_{it} = \alpha_i + \gamma_t + \beta \cdot Treatment_{it} + \varepsilon_{it}. \tag{9}$$

The key intuition is the following.

Treatment does not occur when the law is passed, but when the drug is actually processed under the new pricing regime. Staggered DiD exploits this variation.

At any point in time, you compare:

- drugs already treated,
- to drugs not yet treated.

This provides a more credible counterfactual than a simple before–after comparison.

9 Event Study Specification

To strengthen your analysis, you should estimate an event-study specification.

Define event time:

$$\tau_{it} = t - G_i. \tag{10}$$

Then estimate:

$$Y_{it} = \alpha_i + \gamma_t + \sum_{k \neq -1} \beta_k \cdot 1\{\tau_{it} = k\} + \varepsilon_{it}. \tag{11}$$

This allows you to:

- test whether treated and control drugs follow similar trends before treatment,
- examine how prices adjust over time after exposure.

10 Recommended Strategy

You should think of your empirical strategy as a progression:

1. Start with generics vs originators (baseline).
2. Add imported vs local (robustness).
3. Refine treatment using the binding constraint.
4. If data allow, move to staggered DiD.

Each step improves your identification by better aligning treatment with the actual functioning of the policy.

11 Extension: Impact on Local Production

Once you have established the effect of the reform on prices, I strongly encourage you to extend your analysis.

In my view, the deeper objective of the regulation is not only to control prices, but also to reshape incentives in the pharmaceutical sector—in particular, to encourage local production.

You could therefore examine whether the reform affected:

- the share of locally produced drugs,
- entry of domestic manufacturers,
- substitution from imports to local production.

Conceptually, the pricing rules (including integration requirements and benchmarking) may alter the relative profitability of importing versus producing locally.

Studying this margin would allow you to move from price effects to broader industrial policy implications, and would significantly strengthen the contribution of your work.